

Research Note 82-9

(1)

BASELINE DATA, VOLUME 1:

LIKELIHOOD OF OCCURRENCE (ONE OR MORE TIMES) OF
INFORMATION-SEEKING OR ERROR EVENTS
UNDER DIFFERENT TASK CONDITIONS

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D. L. Schurman and A. J. Porsche
Applied Science Associates, Inc.

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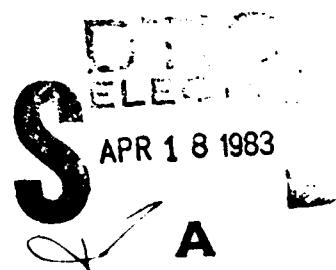


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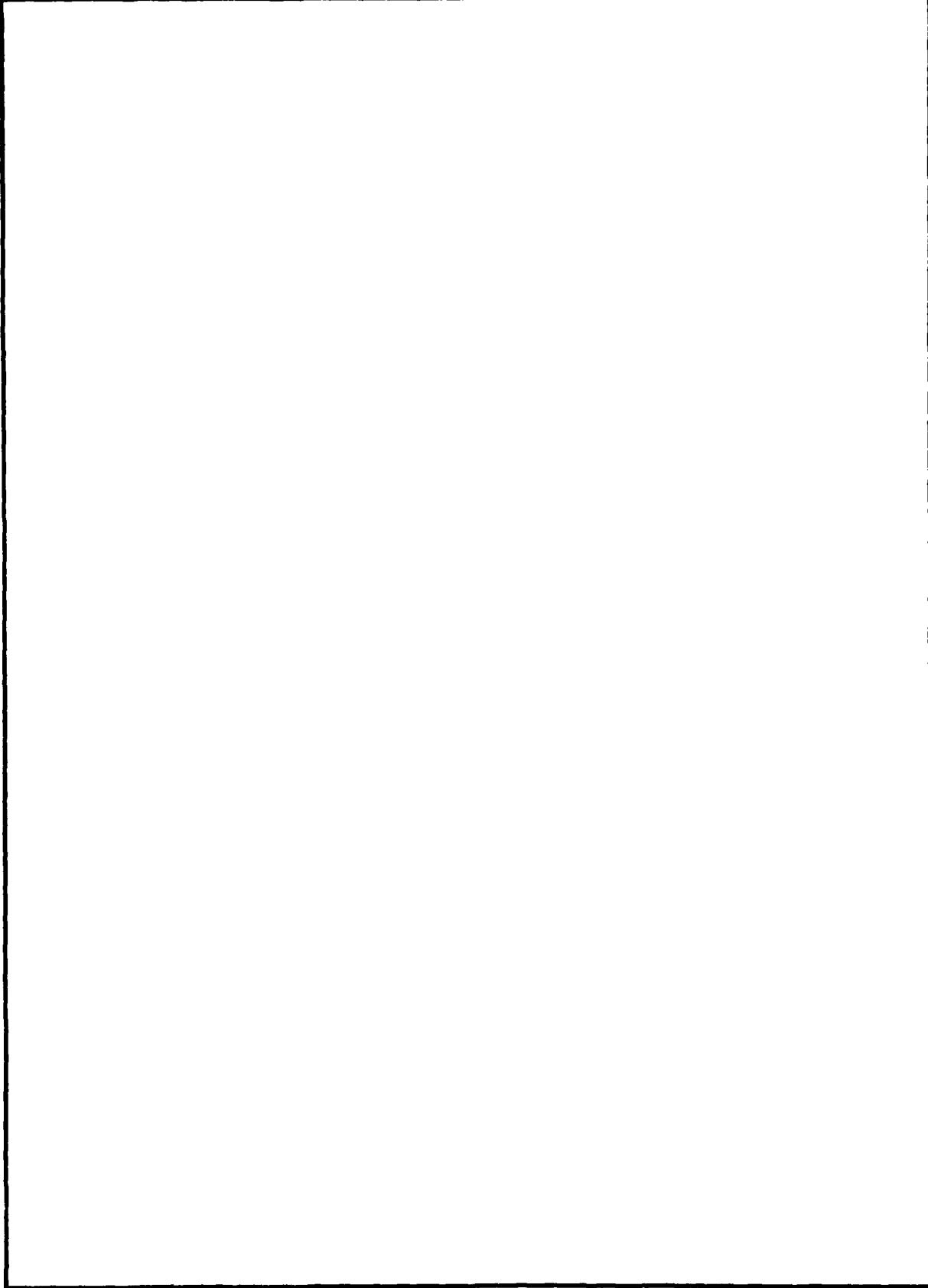
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Data on occurrence of information seeking and performance errors are presented for track and wheel vehicle mechanics classified by amount of prior task experience. Within this framework, information seeking behaviors are identified by type of information source used and type of information sought in relation to characteristics of the task performed. Error data is similarly displayed for type of performance error in relation to presence or absence of information seeking during the task performance and characteristics of the task performed.		

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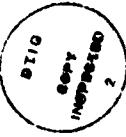
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20. (continued)

These data are based on unobtrusive observations of US Army mechanics performing their usual duties at their normal work sites. These observations were restricted to organizational-level motor pools and to mechanical repair tasks on vehicles in the M151 jeep series, M35 2 1/2-ton truck series, M54 5-ton truck series, M113 armored personnel carrier series, and M60 tank series. Observers recorded the mechanics' performance in a step-by-step fashion, when information was sought during the performance and the errors made during the performance.

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PREFACE

This report represents 1 of 3 volumes of tables presenting data on mechanics use of job-site information sources and quality of their accompanying task performance under routine, work-site conditions. Each volume presents different information on this data base. The three volumes are:

Baseline data, Volume 1: Likelihood of occurrence (one or more times) of information-seeking or error events under different task conditions. This volume presents the data as a basis for estimating the probability or likelihood of mechanics using manuals or other information sources and making errors during performance of different types of tasks.

Baseline data, Volume 2: Relative frequency of types of information-seeking or error events occurring under each type of task condition. This volume provides a basis for focusing on the types of information sought and the types of errors made in relation to each of the different task characteristics and type of tasks identified.

Baseline data, Volume 3: Mean frequency for types of information-seeking or error events occurring under each type of task condition. Tables in this volume parallel those in Volume 2, but present, instead of relative frequencies, the average number of times information sources were used or errors were made by the mechanics who sought information or made errors during the work assignment.

Data presented in the three volumes of this series are intended for use in identifying job-site information needs of organizational level mechanics. In addition, they are intended for future research use as baseline data in evaluating the impact of new job-site information sources and/or shop management practices on mechanics' performance.

Data in these volumes were collected as part of a research project addressing the following two major objectives:

1. develop a method for evaluating use and effectiveness of manuals and other sources of work-site information used by mechanics under routine work-site conditions.
2. develop methods to improve prediction of mechanics' work-site information needs.

During this research a method was developed for observing and recording mechanics performing tasks assigned to them under the usual assignment practices employed in their shops. The observer did not intervene during task performance. No special arrangements were made to insure that the proper tools, manuals, or other resources were readily available to the mechanic while performing the assigned work. In other words, with the exception of the observer's presence, conditions were just as they would have been if the observer had not been present.

Before conducting the observations, detailed task analyses were developed on a large pool of tasks organizational level mechanics are expected to perform on five types of vehicles. The five types of vehicles were the M60 tank series, M113 armored personnel carrier series, M151 jeep series, M35 2½-ton truck series, and the M54 5-ton truck series. During the task performance the observer recorded a written description, in a step-by-step fashion, of:

1. activity being performed and how it was performed.
2. when information was sought in the context of the ongoing activity.
3. source and identity of information sought and obtained.
4. errors made (corrected, uncorrected and omissions).

Only tasks that directly involved mechanical maintenance were observed. Assignments that involved only inspection of equipment such as quarterly inspections were not observed for this purpose. With this exception, the tasks observed were sampled from the daily work load being performed in each shop. As a result, these observations are based on the commonly occurring, "bread and butter" tasks performed at the organizational maintenance level.

The 300 observations on which these volumes are based were obtained by observing 236 organizational level mechanics (MOS 63C and 63B) located in five US Army combat arms divisions. The observations were conducted during the fall to winter of 1978-1979 and again during the fall to winter of 1979-1980. The research and observational methodology upon which data in this and the remaining two volumes are based are described in the following reports:

Schurman, D.L., Porsche, A.J., & Joyce, R.P. Assessing use of information sources and quality of performance at the work site. Applied Science Associates, Inc., Valencia, PA, Report No. 604, December, 1980.

Schurman, D.L., Porsche, A.J., Garbin, C.P., & Joyce, R.P. Guidelines: Assessing use of information sources and quality of performance at the work site. Applied Science Associates, Inc., Valencia, PA, Report 603, December 1980.

Structure of the Normative Tables In This Volume

The percentages presented in the following tables are based on 300 observations. These observations are distributed among the three "Prior Task Experience Levels" in the following manner: 7 or more (n=128); 1-6 (n=100); none (n=72).

The first six tables in this volume are based on observations containing one or more information seeking events (seekers) and observations without information seeking events (nonseekers). The percentages of seekers and nonseekers are based on the total number of observations for one level of a single task characteristic or on total observations for a single task type and will sum to 100 percent. However, the percentages presented for seekers with one or more process errors and seekers committing one or more serious uncorrected errors are based on the number of observations with one or more information seeking events only. These percentages will not add up to 100 percent but are, in fact; a proper subset of the percentage of observations containing one or more information seeking events. The number of observations these percentages are based on is not presented but can be easily derived by multiplying the percentage of observations containing one or more information seeking events by the total number of observations listed at the top of each column. The preceding comments also apply to percentages of nonseekers with one or more process errors and nonseekers with one or more serious uncorrected errors.

For the remaining tables in this volume all percentages are based on total observations for one level (easy/hard) of a single task characteristic, or on total observations for a single task type. This number of total observations is located at the top of each column. Given that any one observation can contain several information seeking events from more than one source and of more than one type, the column percentages will not add up to 100 percent. Similarly the error tables, based on seven different types, display the same statistical phenomenon.

NORMATIVE TABLES OF WORK BEHAVIOR
FOR WHEEL AND TRACK MECHANICS
(63B/C MOS)

Volume 1 of 3

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RELATIONSHIPS BETWEEN INFORMATION SEEKING (ISB) AND ERROR-MAKING (EMB)
BEHAVIORS BY LEVELS OF TASK CHARACTERISTICS
 (Percent of Appropriate Total)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
ISB AND EMB	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n= 57	Unclear n= 50	Unclear n= 78
% of Observations Containing One or More Information Seeking Events (Seekers)	34	40	33	40	31	44	24
% of Seekers With One or More Process Errors	88	78	89	79	91	76	92
% of Seekers Committing One or More Serious Uncorrected Errors	58	48	50	55	64	44	42
% of Observations Containing No Information Seeking Events (Nonseekers)	66	60	67	60	69	56	76
% of Nonseekers With One or More Process Errors	85	82	84	84	78	94	74
% of Nonseekers Committing One or More Serious Uncorrected Errors	55	82	59	73	6	63	71

*C. or C... entries in this cell.

RELATIONSHIPS BETWEEN INFORMATION-SEEKING (ISB) AND ERROR-MAKING (EMB) BEHAVIORS BY LEVELS OF TASK CHARACTERISTICS

(Percent of Appropriate Total)

PRIOR TASK EXPERIENCE LEVEL: 1 = 6

Task Characteristics													
Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
ISB AND EMB		Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 61	Unclear n= 39	Clear n= 61	Unclear n= 39	None n= 38	One or More n= 62	None n= 18	One or More n= 82
% of Observations Containing One or More Information Seeking Events (Seekers)	57	67	59	64	59	67	56	66	60	64	47	71	44
% of Seekers With One or More Process Errors	90	97	87	97	92	96	95	93	94	94	93	88*	94
% of Seekers Committing One or More Serious Uncorrected Errors	58	71	52	72	61	69	64	65	57	70	39	73	50*
% of Observations Containing No Information Seeking Events (Nonseekers)	43	33	41	36	41	33	44	34	40	36	53	29	56
% of Nonseekers With One or More Process Errors	74	87	75	82	77	92	88	71	63	94	65	94	90
% of Nonseekers Committing One or More Serious Uncorrected Errors	52	41	69	36	52	46	47	52	21	79	20	83	50

RELATIONSHIPS BETWEEN INFORMATION SEEKING (ISB) AND ERROR-MAKING (EMB)
BEHAVIORS BY LEVELS OF TASK CHARACTERISTICS
 (Percent of Appropriate Total)

PRIOR TASK EXPERIENCE LEVEL: NONE

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
ISB AND EMB	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 43	Unclear n= 28	Unclear n= 44
% of Observations Containing One or More Information Seeking Events (Seekers)	63	91	62	68	65	90	61
% of Seekers With One or More Process Errors	76	93	78	89	71	100	71
% of Seekers Committing One or More Serious Uncorrected Errors	52	66	61	58	46	73	53
% of Observations Containing No Information Seeking Events (Nonseekers)	37	9	38	32	35	10	39
% of Nonseekers With One or More Process Errors	87	67*	82	35	87	67*	82
% of Nonseekers Committing One or More Serious Uncorrected Errors	40	0*	27	18	33*	27	43*

**RELATIONSHIPS BETWEEN INFORMATION-SEEKING (ISB) AND
ERROR-MAKING (EMB) BEHAVIORS BY TASK TYPES**
(Percent of Appropriate Total)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

		GENERAL TASK TYPES		
ISB and EMB		Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15
% of Observations Containing One or More Information Seeking Events (Seekers)	47	11	7	59
% of Seekers With One or More Process Errors	89*	100*	100*	68
% of Seekers Committing One or More Serious Uncorrected Errors	44*	67*	100*	36
% of Observations Containing No Information Seeking Events (Nonseekers)	53	89	93	41
% of Nonseekers With One or More Process Errors	100	79	57	93
% of Nonseekers Committing One or More Serious Uncorrected Errors	80	54	36	73

*Cau. P. int. o th. ch. base ton le. than 10 c.i.

**RELATIONSHIPS BETWEEN INFORMATION SEEKING (ISB) AND
ERROR-MAKING (EMB) BEHAVIORS BY TASK TYPES**
(Percent of Appropriate Total)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

		GENERAL TASK TYPES				
ISB and EMB		Component Part Replacement <i>n</i> = 26	Preventive Maintenance <i>n</i> = 14	Drivetrain <i>n</i> = 10	Brake <i>n</i> = 28	Suspension and Wheel <i>n</i> = 22
% of Observations Containing One or More Information Seeking Events (Seekers)	65	79	60	61	50	
% of Seekers With One or More Process Errors	100	91	100*	88	91	
% of Seekers Committing One or More Serious Uncorrected Errors	71	64	50*	65	64	
% of Observations Containing No Information Seeking Events (Nonseekers)	35	21	40	39	50	
% of Nonseekers With One or More Process Errors	56*	100*	100*	73	91	
% of Nonseekers Committing One or More Serious Uncorrected Errors	33*	100*	25*	27	82	

*Circumstances in this cell based on less than 10 cases.

**RELATIONSHIPS BETWEEN INFORMATION-SEEKING (ISB) AND
ERROR-MAKING (EMB) BEHAVIORS BY TASK TYPES**
(Percent of Appropriate Total)
PRIOR TASK EXPERIENCE LEVEL: NONE

ISB and EMB	GENERAL TASK TYPES			
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12
% of Observations Containing One or More Information Seeking Events (Seekers)	68	73	57*	75
% of Seekers With One or More Process Errors	73	82	100*	78*
% of Seekers Committing One or More Serious Uncorrected Errors	53	45	75*	56*
% of Observations Containing No Information Seeking Events (Nonseekers)	32	27	43*	25
% of Nonseekers With One or More Process Errors	71*	100*	100*	67*
% of Nonseekers Committing One or More Serious Uncorrected Errors	14*	50*	67*	0*

*P-value < .05. **P-value < .01. ***P-value < .001.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

		TASK CHARACTERISTICS													
		Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required		Operational Check Required	
Source From Which Information Sought		Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n= 71	Unclear n= 57	Clear n= 50	Unclear n= 78	None n= 59	One or More n= 69	None n= 48	One or More n= 80	None n= 24	One or More n= 104
Person - Ask (%)		20	39	20	34	17	42	16	36	27	29	31	26	13	32
Person - Discuss (%)		23	28	18	30	24	26	14	32	24	26	29	23	25	25
Printed Material (%)		7	5	7	5	7	5	4	8	5	7	6	6	4	7

*Caution Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL:1 - 6

TASK CHARACTERISTICS										
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Clarity of Techniques to Perform Task Steps		Operational Check Required	
Source From Which Information Sought	Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 61	Unclear n= 39	Clear n= 61	Unclear n= 39	None or More n= 47	One or More n= 53
Person - Ask (%)	52	57	49	57	49	62	56	52	53	55
Person - Discuss (%)	22	35	23	31	26	31	23	31	19	36
Printed Material (%)	26	35	23	34	23	41	26	33	26	34

*Caution Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

TASK CHARACTERISTICS									
Visual Accessibility	Manual Accessibility			Clarity of Techniques to Perform Task Steps		Special Tools Required		Formal Specs Required	
	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 43	Unclear n= 29	Clear n= 28	Unclear n= 44	None n= 37
Source From Which Information Sought	53	75	48	72	51	79	43	75	49
Person - Ask (%)									77
Person - Discuss (%)	30	53	24	51	37	45	29	48	32
Printed Material (%)	20	53	28	40	28	45	21	43	27
									None n= 40
									One or More n= 32
									One or More n= 14
									One or More n= 58

*Caution Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Observations of Each Task Type)

PRIORITY TASK EXPERIENCE LEVEL: 7 OR MORE

Source From Which Information Sought	GENERAL TASK TYPES			
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15	Brake n = 37
Suspension and Wheel n = 30				
Person - Ask (%)	32	7	0	51
				30
Person - Discuss (%)	37	4	7	41
				27
Printed Material (%)	0	7	0	8
				10

*Caution Percentage in this Cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Source From Which Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain n = 10	Brake n = 28	Suspension and Wheel n = 22
Person - Ask (%)	38	50	60	68	55
Person - Discuss (%)	23	57	20	32	14
Printed Material (%)	23	43	20	32	32

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR INFORMATION SOURCE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Source From Which Information Sought	GENERAL TASK TYPES				
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12	Suspension and Wheel n = 16
Person - Ask (%)	55	57	57*	50	94
Person - Discuss (%)	41	40	14*	33	56
Printed Material (%)	27	40	14*	50	38

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

TASK CHARACTERISTICS

	TASK CHARACTERISTICS						Operational Check Required		
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	One or More n=48	None n=80	One or More n=24
Types of Information Sought	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n=71	Unclear n=57	None n= 59	One or More n=69	None n=104
Location/Identification of Components (%)	3	0	2	1	3	0	2	1	3
Technique for a Task Step (%)	18	21	18	21	10	26	15	23	18
Task Steps Required for Completion (%)	11	14	11	14	13	12	8	15	10
Formal Specification Data (%)	6	5	5	5	3	9	2	8	7
Help on Serviceability Judgement (%)	6	21	7	16	6	21	6	17	9
Help on Alignment Judgement (%)	7	11	5	11	8	9	10	8	5
							5	12	2
							13	13	8
							9	9	9

*Caution: Percentage in this table is based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

TASK CHARACTERISTICS								
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	One or More n= 38	One or More n= 62
	Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 39	Unclear n= 61	None n= 47	None n= 18
Types of Information Sought	11	9	10	10	10	10	13	8
Location/Identification of Components (%)	39	50	36	49	39	51	36	49
Technique for a Task Step (%)	13	17	10	18	15	15	20	40
Task Steps Required for Completion (%)	19	13	21	13	10	26	18	15
Formal Specification Data (%)	6	17	8	13	7	18	5	15
Help on Serviceability Judgement (%)	7	15	3	16	13	8	13	9
Help on Alignment Judgement (%)							3	16
							0	13

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

TASK CHARACTERISTICS									
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	One or More n= 40	One or More n= 14
	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 28	Unclear n= 44	None n= 37	One or More n= 35	None n= 32
Types of Information Sought	13	25	14	21	16	21	11	23	16
Location/Identification of Components (%)								20	22
Technique for a Task Step (%)	43	56	38	56	42	59	39	55	35
Task Steps Required for Completion (%)	25	47	28	40	30	41	29	39	27
Formal Specification Data (%)	10	31	10	26	14	28	14	23	11
Help on Serviceability Judgement (%)	10	13	3	16	7	17	7	14	5
Help on Alignment Judgement (%)	3	13	0	12	2	14	0	11	3

Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Observations of Each Task Type)

PRIORITY TASK EXPERIENCE LEVEL: 7 OR MORE

	GENERAL TASK TYPES				
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15	Brake n = 37	Suspension and Wheel n = 30
Location/Identification of Components (%)	11	0	0	0	0
Technique for a Task Step (%)	26	7	7	27	23
Task Steps Required for Completion (%)	26	4	0	19	10
Formal Specification Data (%)	4	4	0	11	3
Help on Serviceability Judgement (%)	4	0	0	35	7
Help on Alignment Judgement (%)	16	4	0	6	17

*Caution: Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 63B/C, 1978-80

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL:1 - 6

	GENERAL TASK TYPES			
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain n = 10	Brake n = 28
Types of Information Sought				Suspension and Wheel n = 22
Location/Identification of Components (%)	12	22	10	0
Technique for a Task Step (%)	54	42	40	39
Task Steps Required for Completion (%)	19	7	0	21
Formal Specification Data (%)	8	42	10	21
Help on Serviceability Judgement (%)	8	7	10	11
Help on Alignment Judgement (%)	0	7	20	18

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS,
LISTED BY MAJOR TYPE OF INFORMATION SOUGHT**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

	GENERAL TASK TYPES				
	Component Part Replacement <i>n</i> = 22	Preventive Maintenance <i>n</i> = 15	Drivetrain <i>n</i> = 7	Brake <i>n</i> = 12	
Types of Information Sought					
Location/Identification of Components (%)	23	27	0*	8	19
Technique for a Task Step (%)	41	40	43*	33	81
Task Steps Required for Completion (%)	23	33	29*	50	44
Formal Specification Data (%)	14	7	43*	25	25
Help on Serviceability Judgement (%)	18	0	14*	0	19
Help on Alignment Judgement (%)	5	7	0*	0	19

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

TASK CHARACTERISTICS								
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	One or More n=80	None or More n=24
Types of Information Sought	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n= 71	Unclear n= 57	Unclear n= 78	None or More n= 69
Location/Identification of Components (%)	1	0	2	0	1	0	2	0
Technique for a Task Step (%)	8	9	9	8	7	11	6	10
Task Steps Required for Completion (%)	4	7	4	7	4	7	8	7
Formal Specification Data (%)	1	2	2	1	0	4	0	3
Help on Serviceability Judgement (%)	4	23	5	18	4	23	4	18
Help on Alignment Judgement (%)	6	9	4	10	6	9	6	3

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: 1 – 6

TASK CHARACTERISTICS									
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required		
Types of Information Sought	Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 61	Unclear n= 39	Clear n= 39	Unclear n= 61	None or More n= 47
Location/Identification of Components (%)	9	7	10	10	5	13	5	11	6
Technique for a Task Step (%)	28	26	28	21	36	26	28	26	28
Task Steps Required for Completion (%)	7	4	8	5	8	3	5	7	6
Formal Specification Data (%)	7	4	10	3	5	8	10	3	4
Help on Serviceability Judgement (%)	6	17	8	13	7	18	5	15	9
Help on Alignment Judgement (%)	7	15	3	16	13	8	13	10	13

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL:NONE

TASK CHARACTERISTICS								
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Information Sought	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 28	Unclear n= 29	None or More n= 44	One or More n= 35
Location/Identification of Components (%)	10	9	10	9	12	7	11	9
Technique for a Task Step (%)	33	47	34	42	33	48	32	43
Task Steps Required for Completion (%)	18	13	17	14	14	17	14	16
Formal Specification Data (%)	5	9	0	12	2	14	0	11
Help on Serviceability Judgement (%)	10	16	3	19	7	21	7	16
Help on Alignment Judgement (%)	3	13	0	12	2	14	0	11

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

TASK CHARACTERISTICS									
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	One or More n=80	None n=48	One or More n=24
	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n=71	Unclear n=57	None n= 59	One or More n= 69	None or More n= 104
Types of Information Sought	1	0	0	1	1	0	1	2	0
Location/Identification of Components (%)	15	16	13	18	15	16	6	22	10
Technique for a Task Step (%)	7	12	5	12	8	11	4	13	10
Task Steps Required for Completion (%)	3	0	2	1	1	2	0	3	1
Formal Specification Data (%)	1	2	2	1	1	2	0	1	0
Help on Serviceability Judgement (%)	1	4	2	3	4	0	6	0	2
Help on Alignment Judgement (%)	1	4	2	3	4	0	6	0	3

•Caution: Percentage in this cell based on less than 10 cases

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: 1 – 6

TASK CHARACTERISTICS										
	Visual Accessibility		Manual Accessibility		Clarity of Necessary Task Steps		Special Tools Required		Formal Specs Required	
	Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 39	Unclear n= 39	None n= 61	One or More n= 53	None n= 38	One or More n= 62
Types of Information Sought	2	2	3	2	3	0	0	3	2	3
Location/Identification of Components (%)	19	28	18	26	21	26	21	25	13	32
Technique for a Task Step (%)	4	7	5	5	5	5	5	9	2	3
Task Steps Required for Completion (%)	2	0	3	0	0	3	3	0	2	0
Formal Specification Data (%)	0	2	0	2	0	3	0	2	0	2
Help on Serviceability Judgement (%)	0	0	0	0	0	0	0	2	0	0
Help on Alignment Judgement (%)	0	0	0	0	0	0	0	0	0	0

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: NONE

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Types of Information Sought	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 29	Unclear n= 28	None n= 44
Location/Identification of Components (%)	3	6	3	5	2	7	4
Technique for a Task Step (%)	23	31	14	35	26	24	18
Task Steps Required for Completion (%)	5	19	7	14	7	17	0
Formal Specification Data (%)	0	6	0	5	5	0	7
Help on Serviceability Judgement (%)	0	0	0	0	0	0	0
Help on Alignment Judgement (%)	0	0	0	0	0	0	0

*Caution. Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PRINTED MATERIAL**PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE**

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Types of Information Sought	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n= 71	Unclear n= 57	None or More n= 59
Location/Identification of Components (%)	0	0	0	0	0	0	None or More n= 24
Technique for a Task Step (%)	1	2	1	3	0	3	None or More n= 104
Task Steps Required for Completion (%)	3	2	4	1	3	2	1
Formal Specification Data (%)	4	4	4	4	3	4	5

*Caution Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS - TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PRINTED MATERIAL**PRIOR TASK EXPERIENCE LEVEL: 1 - 6**

TASK CHARACTERISTICS									
Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required			
Types of Information Sought	Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 61	Unclear n= 39	None n= 61	One or More n= 47	None n= 38
Location/Identification of Components (%)	6	7	5	7	5	8	8	5	9
Technique for a Task Step (%)	15	20	10	21	13	23	10	21	17
Task Steps Required for Completion (%)	6	9	3	10	7	8	3	10	6
Formal Specification Data (%)	13	13	13	13	8	21	13	13	6

*Caution Percentage in this cell based on less than 10 cases

BASELINE DATA, MOS 63B/C, 1978-80

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPE BY SOURCE
 (Percent of Total Observation At Each Level of Task Characteristic)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: NONE

TASK CHARACTERISTICS						
Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 29	Unclear n= 28	Unclear n= 44
Types of Information Sought	3	9	3	7	5	0
Location/Identification of Components (%)	8	16	7	14	9	14
Technique for a Task Step (%)	8	22	10	16	14	14
Task Steps Required for Completion (%)	5	25	10	16	9	21
Formal Specification Data (%)						

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

	GENERAL TASK TYPES			
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15	Brake n = 37
Types of Information Sought	5	0	0	0
Location/Identification of Components (%)				
Technique for a Task Step (%)	11	4	0	11
Task Steps Required for Completion (%)	11	0	0	11
Formal Specification Data (%)	5	0	0	3
Help on Serviceability Judgement (%)	5	0	0	35
Help on Alignment Judgement (%)	11	4	0	5
				13

*Caution Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PERSON – ASK**PRIOR TASK EXPERIENCE LEVEL: 1 – 6**

	GENERAL TASK TYPES			
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain	Brake
Types of Information Sought	4	14	20	0
Location/Identification of Components (%)	27	14	20	36
Technique for a Task Step (%)	4	7	0	7
Task Steps Required for Completion (%)	0	14	10	11
Formal Specification Data (%)	8	7	10	11
Help on Serviceability Judgement (%)	0	7	20	18
Help on Alignment Judgement (%)	0	7	0	14

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PERSON – ASK

PRIOR TASK EXPERIENCE LEVEL: NONE

	GENERAL TASK TYPES			
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12
	Suspension and Wheel n = 16			
Types of Information Sought				
Location/Identification of Components (%)	5	20	0*	0
Technique for a Task Step (%)	23	27	43*	33
Task Steps Required for Completion (%)	10	20	14*	17
Formal Specification Data (%)	10	0	14*	8
Help on Serviceability Judgement (%)	23	0	14*	0
Help on Alignment Judgement (%)	5	7	0*	0

*Caution Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PERSON – DISCUSS

PRIORITY TASK EXPERIENCE LEVEL: 7 OR MORE

	GENERAL TASK TYPES			
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15	Brake n = 37
Types of Information Sought	5	0	0	0
Location/Identification of Components (%)	21	4	7	22
Technique for a Task Step (%)	21	0	0	16
Task Steps Required for Completion (%)	0	0	0	7
Formal Specification Data (%)	0	0	0	5
Help on Serviceability Judgement (%)	0	0	0	5
Help on Alignment Judgement (%)	5	0	0	0
				7

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PERSON – DISCUSS

PRIORITY TASK EXPERIENCE LEVEL: 1 – 6

	GENERAL TASK TYPES			
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain n = 10	Brake n = 28
	Suspension and Wheel n = 22			
Types of Information Sought				
Location/Identification of Components (%)	0	14	0	25
Technique for a Task Step (%)	23	43	20	14
Task Steps Required for Completion (%)	4	0	0	4
Formal Specification Data (%)	0	0	0	0
Help on Serviceability Judgement (%)	0	0	0	0
Help on Alignment Judgement (%)	0	0	0	0

*Caution: Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PERSON – DISCUSS

PRIOR TASK EXPERIENCE LEVEL: NONE

	GENERAL TASK TYPES			
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12
Types of Information Sought			0*	0
Location/Identification of Components (%)	9	7	0*	0
Technique for a Task Step (%)	27	20	0*	17
Task Steps Required for Completion (%)	9	13	0*	8
Formal Specification Data (%)	0	0	14*	8
Help on Serviceability Judgement (%)	0	0	0*	0
Help on Alignment Judgement (%)	0	0	0*	0

*Caution Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS – TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

	GENERAL TASK TYPES			
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15	Brake n = 37
Types of Information Sought	0	0	0	0
Location Identification of Components (%)	0	0	0	0
Technique for a Task Step (%)	0	0	0	7
Task Steps Required for Completion (%)	0	4	0	3
Formal Specification Data (%)	0	4	0	8

*Caution Percentage in this cell based on less than 10 cases

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS - TYPES BY SOURCE
 (Percent of Total Observations of Each Task Type)

SOURCE: PRINTED MATERIAL**PRIOR TASK EXPERIENCE LEVEL: 1 - 6**

GENERAL TASK TYPES				
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain n = 10	Brake n = 28
Types of Information Sought	8	0	10	0
Location Identification of Components (%)	19	14	0	21
Technique for a Task Step (%)	8	0	0	11
Task Steps Required for Completion (%)	8	36	10	14
Formal Specification Data (%)	8	0	5	5

*Caution Percentage in this cell based on less than 10 cases.

BASELINE DATA, MOS 63B/C, 1978-80

OBSERVATIONS WITH ONE OR MORE INFORMATION SEEKING EVENTS - TYPES BY SOURCE
(Percent of Total Observations of Each Task Type)

SOURCE: PRINTED MATERIAL

PRIOR TASK EXPERIENCE LEVEL:NONE

GENERAL TASK TYPES					
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12	Suspension and Wheel n = 16
Types of Information Sought	9	7	0*	8	0
Location/Identification of Components (%)	5	13	0*	17	19
Technique for a Task Step (%)	5	13	14*	33	13
Task Steps Required for Completion (%)	14	7	14*	17	19
Formal Specification Data (%)					

*Caution Percentage in this cell based on less than 10 cases

OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS, LISTED BY MAJOR ERROR TYPE
 (Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

All Persons

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Type of Error	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n= 71	Unclear n= 57	Unclear n= 50
Violate Good Mechanical Practice (%)	13	19	11	19	11	21	10
Wrong Technique Used (%)	24	32	24	30	27	28	20
Specification Errors (%)	31	51	31	47	35	46	30
Wrong Part/Component (%)	21	14	20	16	24	11	22
Wrong Order of Steps (%)	35	35	36	34	31	40	34
Wrong Position or Orientation of Part/Component (%)	21	12	20	15	17	18	14
Wrong Adjustment Technique (%)	8	18	11	14	6	21	6

*Caution: Percentage of this type based on less than 100 cases.

OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS, LISTED BY MAJOR ERROR TYPE
 (Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

All Persons

TASK CHARACTERISTICS								
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Error	Easy n= 54	Hard n=46	Easy n= 39	Hard n= 61	Clear n= 61	Unclear n= 39	Unclear n= 61	None n=47
Violate Good Mechanical Practice (%)	15	20	15	18	11	26	10	21
Wrong Technique Used (%)	26	43	23	41	30	41	31	36
Specification Errors (%)	39	43	44	41	39	44	46	38
Wrong Part/Component (%)	20	22	13	26	20	23	21	21
Wrong Order of Steps (%)	24	49	26	41	21	56	23	43
Wrong Position or Orientation of Part/Component (%)	13	20	10	20	16	15	15	16
Wrong Adjustment Technique (%)	11	22	15	16	8	28	5	23

*Caution: Percentage in this cell based on . . . ss th : '0 c.s.

OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS, LISTED BY MAJOR ERROR TYPE
 (Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL:NONE

All Persons

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Type of Error	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 43	Unclear n= 29	Unclear n= 44
Violate Good Mechanical Practice (%)	18	13	17	14	17	11	18
Wrong Technique Used (%)	20	50	17	44	21	52	14
Specification Errors (%)	28	47	21	47	23	55	25
Wrong Part/Component (%)	10	28	10	23	14	24	14
Wrong Order of Steps (%)	38	38	41	35	41	32	41
Wrong Position or Orientation of Part/Component (%)	10	25	10	21	14	21	14
Wrong Adjustment Technique (%)	5	9	7	7	7	11	5

*Caution Percentage in this cell based on less than 10 cases

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

		TASK CHARACTERISTICS							
		Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Error	Easy n= 24	Hard n= 23	Easy n= 18	Hard n= 29	Clear n= 22	Unclear n= 25	Unclear n= 12	None n= 22	None n= 25
Violate Good Mechanical Practice (%)	17	22	17	21	18	20	17	20	9
Wrong Technique Used (%)	29	35	33	31	36	28	33	31	14
Specification Errors (%)	33	48	33	45	41	40	33	43	14
Wrong Part/Component (%)	21	13	22	14	27	8	25	14	18
Wrong Order of Steps (%)	33	43	33	41	27	48	33	40	45
Wrong Position or Orientation of Part/Component (%)	25	13	22	17	18	20	17	20	5
Wrong Adjustment Technique (%)	3	9	11	7	9	8	17	6	9
								5	11
								0*	10

*Caution: Percent in this cell based on less than 10 cases

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**

(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Seekers

		TASK CHARACTERISTICS							
		Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Error	n= 31	Hard n= 31	Easy n= 23	Hard n= 39	Clear n= 36	Unclear n= 26	Unclear n= 40	None n= 28	One or More n= 34
Violate Good Mechanical Practice (%)	13	19	13	18	8	27	5	23	11
Wrong Technique Used (%)	26	48	22	46	31	46	32	40	25
Specification Errors (%)	45	45	43	46	47	42	55	40	21
Wrong Part/Component (%)	23	23	13	28	22	23	23	21	24
Wrong Order of Steps (%)	16	58	26	44	19	62	14	50	29
Wrong Position or Orientation of Part/Component (%)	6	26	0	26	17	15	9	20	11
Wrong Adjustment Technique (%)	16	26	17	23	11	37	9	28	21
								17	16
								13*	17
								0*	24

*Caution: Percentage in this cell based on less than 10 cases.

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**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

Seekers	TASK CHARACTERISTICS							Operational Check Required
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required		
Type of Error	Easy n= 25	Hard n= 29	Easy n= 18	Hard n= 36	Clear n= 28	Unclear n= 26	None n= 17	One or More n= 30
Violate Good Mechanical Practice (%)	20	14	17	17	14	19	12	19
Wrong Technique Used (%)	16	48	11	44	14	54	12	43
Specification Errors (%)	32	52	33	47	29	58	29	49
Wrong Part/Component (%)	12	28	11	25	18	23	18	22
Wrong Order of Steps (%)	32	41	33	39	29	46	24	43
Wrong Position or Orientation of Part/Component (%)	8	28	6	25	14	23	18	19
Wrong Adjustment Technique (%)	8	15	11	8	11	8	18	5

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND NO INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Observations At Each Level of Task Characteristic)

Nonseekers

	TASK CHARACTERISTICS						
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Type of Error	Easy n = 47	Hard n = 34	Easy n = 37	Hard n = 44	Clear n = 49	Unclear n = 32	Unclear n = 43
Violate Good Mechanical Practice (%)	11	18	8	18	8	22	8
Wrong Technique Used (%)	21	29	19	30	22	28	16
Specification Errors (%)	30	53	30	48	33	50	29
Wrong Part/Component (%)	21	15	19	18	22	13	21
Wrong Order of Steps (%)	36	29	39	30	33	34	33
Wrong Position or Orientation of Part/Component (%)	19	12	19	14	16	16	13
Wrong Adjustment Technique (%)	9	21	11	18	4	31	3

•Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND NO INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Nonseekers

		TASK CHARACTERISTICS						
		Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Type of Error		Easy n= 23	Hard n= 15	Easy n= 16	Hard n= 22	Clear n= 25	Unclear n= 13	None n= 21
Violate Good Mechanical Practice (%)	17	20	19	18	16	23	18	19
Wrong Technique Used (%)	26	33	25	32	28	31	29	29
Specification Errors (%)	30	47	44	36	32	46	35	38
Wrong Part/Component (%)	17	20	13	23	16	23	18	19
Wrong Order of Steps (%)	35	27	25	36	24	46	35	29
Wrong Position or Orientation of Part/Component (%)	22	7	25	9	16	15	24	10
Wrong Adjustment Technique (%)	4	13	13	5	4	15	0	14
						5	11	10
						11	6	0
						11	0	11

*Caution Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND NO INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
 (Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

Nonseekers	TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Error	Easy n= 15	Hard n= 3	Easy n= 11	Hard n= 7	Clear n= 15	Unclear n= 3	Clear n= 11	Unclear n= 7
Violate Good Mechanical Practice (%)	13	0*	18	0*	13	0*	9	14*
Wrong Technique Used (%)	27	67*	27	43*	33	33*	18	57*
Specification Errors (%)	20	0*	0	43*	13	33*	18	14*
Wrong Part/Component (%)	7	33*	9	14*	7	33*	9	14*
Wrong Order of Steps (%)	47	0*	55	14*	47	0*	45	29*
Wrong Position or Orientation of Part/Component (%)	13	0*	18	0*	13	0*	9	14*
Wrong Adjustment Technique (%)	0	0*	0	0*	0	0*	0	0*

*Caution Percentage in this cell based on less than 10 cases.

OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS, LISTED BY MAJOR ERROR TYPE
 (Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Type of Error	GENERAL TASK TYPES				Suspension and Wheel n = 30
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15	Brake n = 37	
Violate Good Mechanical Practice (%)	0	7	7	14	40
Wrong Technique Used (%)	21	2	20	8	60
Specification Errors	42	30	20	32	67
Wrong Part/Component (%)	37	19	7	5	27
Wrong Order of Steps (%)	26	33	20	46	37
Wrong Position or Orientation of Part/Component (%)	21	22	0	8	30
Wrong Adjustment Technique (%)	0	15	7	19	13

*Caution Percentage in this cell based on less than 10 cases

OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS, LISTED BY MAJOR ERROR TYPE
 (Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Type of Error All Persons	GENERAL TASK TYPES			
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain n = 10	Brake Suspension and Wheel n = 22
Violate Good Mechanical Practice (%)	12	14	30	18
Wrong Technique Used (%)	46	21	30	11
Specification Errors (%)	38	43	40	25
Wrong Part/Component (%)	35	14	0	14
Wrong Order of Steps (%)	38	36	30	29
Wrong Position or Orientation of Part Component (%)	23	29	0	4
Wrong Adjustment Technique (%)	8	50	10	18

*Caution: Percentage in this cell based on less than 10 cases

OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS, LISTED BY MAJOR ERROR TYPE
 (Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Type of Error	GENERAL TASK TYPES			
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12
Violate Good Mechanical Practice (%)	5	7	29*	25
Wrong Technique Used (%)	18	13	14*	33
Specification Errors (%)	23	20	57*	25
Wrong Part/Component (%)	14	20	29*	17
Wrong Order of Steps (%)	55	33	29*	33
Wrong Position or Orientation of Part/Component (%)	18	0	29*	8
Wrong Adjustment Technique (%)	5	7	0	17
				6

*Caution: Percentage in this cell based on less than 10 cases

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Seekers	GENERAL TASK TYPES				
	Component Part Replacement n = 9	Preventive Maintenance n = 3	Drivetrain n = 1	Brake n = 22	Suspension and Wheel n = 12
Violate Good Mechanical Practice (%)	0*	33*	0*	14	42
Wrong Technique Used (%)	33*	33*	100*	5	75
Specification Errors (%)	22*	67*	0*	32	67
Wrong Part/Component (%)	44*	0*	0*	5	25
Wrong Order of Steps (%)	33*	33*	0*	45	33
Wrong Position or Orientation of Part/Component (%)	11*	33*	0*	5	50
Wrong Adjustment Technique (%)	0*	0*	0*	9	17

*Carrying Percentage in this cell based on less than 10 cases

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Seekers	GENERAL TASK TYPES				
	Component Part Replacement n = 16	Preventive Maintenance n = 11	Drivetrain n = 6	Brake n = 17	Suspension and Wheel n = 12
Violate Good Mechanical Practice (%)	12	9	17*	18	25
Wrong Technique Used (%)	62	27	17*	6	67
Specification Errors (%)	56	36	50*	41	42
Wrong Part/Component (%)	37	18	0*	12	33
Wrong Order of Steps (%)	50	36	17*	35	33
Wrong Position or Orientation of Part/Component (%)	31	27	0*	6	8
Wrong Adjustment Technique (%)	12	55	0*	24	8

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Seekers	GENERAL TASK TYPES				
	Component Part Replacement n = 15	Preventive Maintenance n = 11	Drivetrain n = 4	Brake n = 9	Suspension and Wheel n = 15
Violate Good Mechanical Practice (%)	7	9	25*	33*	20
Wrong Technique Used (%)	13	9	25*	22*	80
Specification Errors (%)	33	18	50*	33*	73
Wrong Part/Component (%)	20	9	50*	22*	20
Wrong Order of Steps (%)	53	36	25*	33*	27
Wrong Position or Orientation of Part/Component (%)	20	0	50*	11*	27
Wrong Adjustment Technique (%)	7	9	0*	22*	7

*Column Percentage in this cell based on less than 10 cases

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND NO INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Nonseekers	GENERAL TASK TYPES				
	Component Part Replacement n = 10	Preventive Maintenance n = 24	Drivetrain n = 14	Brake n = 15	Suspension and Wheel n = 18
Violate Good Mechanical Practice (%)	0	4	7	13	38
Wrong Technique Used (%)	10	25	14	13	50
Specification Errors (%)	60	25	21	33	67
Wrong Part/Component (%)	30	21	7	7	28
Wrong Order of Steps (%)	20	33	21	47	39
Wrong Position or Orientation of Part/Component (%)	30	21	0	13	17
Wrong Adjustment Technique (%)	0	17	7	33	11

*Caution: Percentages in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND NO INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Nonseekers	GENERAL TASK TYPES				Suspension and Wheel n = 10
	Component Part Replacement n = 10	Preventive Maintenance n = 3	Drivetrain n = 4	Brake n = 11	
Violate Good Mechanical Practice (%)	10	33*	50*	18	10
Wrong Technique Used (%)	20	0*	50*	18	50
Specification Errors (%)	10	67*	25*	9	80
Wrong Part/Component (%)	30	0*	0*	18	20
Wrong Order of Steps (%)	20	33*	50*	18	50
Wrong Position or Orientation of Part/Component (%)	10	33*	0*	0	40
Wrong Adjustment Technique (%)	0	33*	25*	9	0

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE PROCESS ERRORS AND NO INFORMATION SEEKING,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Nonseekers		GENERAL TASK TYPES			
Type of Error	Component Part Replacement n = 7	Preventive Maintenance n = 4	Drivetrain n = 3	Brake n = 3	Suspension and Wheel n = 1
Violate Good Mechanical Practice (%)	0*	0*	33*	0*	100*
Wrong Technique Used (%)	29*	25*	0*	67*	100*
Specification Errors (%)	0*	25*	67*	0*	0*
Wrong Part/Component (%)	0*	50*	0*	0*	0*
Wrong Order of Steps (%)	57*	25*	33*	33*	0*
Wrong Position or Orientation of Part/Component (%)	14*	0*	0*	0*	100*
Wrong Adjustment Technique (%)	0*	0*	0*	0*	0*

*Greatest percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

All Persons

TASK CHARACTERISTICS									
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	One or More n= 80	One or More n= 24
Type of Error	Easy n= 71	Hard n= 57	Easy n= 55	Hard n= 73	Clear n= 71	Unclear n= 57	Unclar n= 50	None n= 59	None n= 48
Violate Good Mechanical Practice (%)	0	2	0	1	0	2	0	1	0
Wrong Technique Used (%)	7	23	7	19	11	18	6	19	3
Specification Errors (%)	31	51	29	48	35	46	32	45	10
Wrong Part/Component (%)	17	0	16	4	17	0	16	5	10
Wrong Order of Steps (%)	14	9	16	8	13	11	18	8	12
Wrong Position or Orientation of Part/Component (%)	1	2	2	1	1	2	2	1	2
Wrong Adjustment Technique (%)	4	11	5	8	4	11	2	10	7

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

All Persons

TASK CHARACTERISTICS								
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Error	Easy n= 54	Hard n= 46	Easy n= 39	Hard n= 61	Clear n= 61	Unclear n= 39	Clear n= 39	Unclear n= 61
Violate Good Mechanical Practice (%)	2	4	3	3	3	0	5	6
Wrong Technique Used (%)	9	17	10	15	10	18	13	13
Specification Errors (%)	41	43	44	41	43	41	46	39
Wrong Part/Component (%)	15	13	8	18	15	13	15	13
Wrong Order of Steps (%)	7	7	10	5	7	8	10	5
Wrong Position or Orientation of Part/Component (%)	0	4	0	3	2	3	0	3
Wrong Adjustment Technique (%)	4	13	8	8	7	10	3	11

*Caution Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

All Persons

TASK CHARACTERISTICS									
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	None or More n= 14	None or More n= 40
Type of Error	Easy n= 40	Hard n= 32	Easy n= 29	Hard n= 43	Clear n= 29	Unclear n= 28	Unclear n= 44	None n= 37	One or More n= 35
Violate Good Mechanical Practice (%)	0	9	3	5	5	3	4	5	3
Wrong Technique Used (%)	5	12	7	9	2	17	0	14	0
Specification Errors	27	50	21	49	23	59	25	45	8
Wrong Part/Component (%)	2	12	10	9	9	10	11	9	11
Wrong Order of Steps (%)	12	6	10	9	9	10	7	11	9
Wrong Position or Orientation of Part/Component (%)	0	3	0	2	0	3	0	2	0
Wrong Adjustment Technique (%)	7	3	7	5	7	3	11	2	5
								3	7
								0	7

•Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE**Seekers**

		TASK CHARACTERISTICS								
		Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required		
Type of Error	n	Hard n=23	Easy n=18	Clear n=22	Unclear n=12	None n=25	One or More n=22	None n=19	One or More n=28	None n=6
Violate Good Mechanical Practice (%)	0	0	0	0	0	0	0	0	0	0
Wrong Technique Used (%)	4	26	6	21	14	16	0	20	0	0*
Specification Errors (%)	37	39	33	41	36	4	25	43	9	64
Wrong Part/Component (%)	12	0	11	3	14	0	8	8	9	4
Wrong Order of Steps (%)	12	9	11	10	9	12	17	9	9	11
Wrong Position or Orientation of Part/Component (%)	0	0	0	0	0	0	0	0	0	0*
Wrong Adjustment Technique (%)	4	0	6	0	0	4	0	3	0	4

*Caution Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIORITY TASK EXPERIENCE LEVEL: 1 - 6

Seekers

	TASK CHARACTERISTICS									
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	One or More n= 54	One or More n= 44	None n= 8
Type of Error	Easy n= 31	Hard n= 31	Easy n= 23	Hard n= 39	Clear n= 36	Unclear n= 26	Clear n= 22	Unclear n= 40	None n= 28	One or More n= 34
Violate Good Mechanical Practice (%)	0	3	0	3	0	4	0	2	4	0
Wrong Technique Used (%)	13	16	17	13	14	15	18	12	11	18
Specification Errors (%)	42	48	39	49	47	42	50	42	25	62
Wrong Part/Component (%)	19	13	9	21	17	15	18	15	14	18
Wrong Order of Steps (%)	0	10	0	8	0	12	18	7	4	6
Wrong Position or Orientation of Part/Component (%)	0	6	0	5	3	4	0	5	0	6
Wrong Adjustment Technique (%)	3	16	4	13	8	12	5	12	14	6

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL:NONE

Seekers	TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	None or More n=34	One or More n=11
Type of Error	Easy n= 25	Hard n=29	Easy n= 18	Hard n= 36	Clear n= 28	Unclear n= 17	None n= 24	One or More n= 30
Violate Good Mechanical Practice (%)	0	10	6	7	4	6	5	42
Wrong Technique Used (%)	4	14	6	11	0	19	0	14
Specification Errors (%)	32	55	33	50	29	62	29	51
Wrong Part/Component (%)	8	14	11	11	11	12	12	11
Wrong Order of Steps (%)	16	7	11	11	11	12	11	12
Wrong Position or Orientation of Part/Component (%)	0	3	0	3	0	4	0	3
Wrong Adjustment Technique (%)	12	3	11	6	11	4	18	3

*Caution. Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERROR AND
NO INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Nonseekers

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Type of Error	Easy n= 47	Hard n= 34	Easy n= 37	Hard n= 44	Clear n= 49	Unclear n= 32	Unclear n= 43
Violate Good Mechanical Practice (%)	0	3	0	2	0	3	0
Wrong Technique Used (%)	9	21	8	18	10	19	8
Specification Errors (%)	28	59	27	52	35	50	34
Wrong Part/Component (%)	19	0	19	5	18	0	18
Wrong Order of Steps (%)	15	9	19	7	14	9	18
Wrong Position or Orientation of Part/Component (%)	2	3	3	2	2	3	2
Wrong Adjustment Technique (%)	4	18	5	14	6	16	3

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERROR AND
NO INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Nonseekers	TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required	
Type of Error	Easy n= 23	Hard n= 15	Easy n= 16	Hard n= 22	Clear n= 25	Unclear n= 13	Clear n= 17	Unclear n= 21
Violate Good Mechanical Practice (%)	4	7	6	5	8	0	0	10
Wrong Technique Used (%)	4	20	0	18	4	23	6	14
Specification Errors (%)	39	33	50	27	36	38	41	33
Wrong Part/Component (%)	9	13	6	14	12	8	6	14
Wrong Order of Steps (%)	17	0	25	0	16	0	24	0
Wrong Position or Orientation of Part/Component (%)	0	0	0	0	0	0	0	0
Wrong Adjustment Technique (%)	4	7	12	0	4	8	0	10

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERROR AND
NO INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations At Each Level of Task Characteristic)

PRIOR TASK EXPERIENCE LEVEL: NONE

Nonseekers

TASK CHARACTERISTICS							
	Visual Accessibility	Manual Accessibility	Clarity of Necessary Task Steps	Clarity of Techniques to Perform Task Steps	Special Tools Required	Formal Specs Required	Operational Check Required
Type of Error	Easy n= 15	Hard n= 3	Easy n= 11	Hard n= 7	Clear n= 15	Unclear n= 3	None n= 7
Violate Good Mechanical Practice (%)	0	0*	0	0*	0	0*	0
Wrong Technique Used (%)	7	0*	9	0*	7	0*	14*
Specification Errors (%)	20	0*	0	43*	13	33*	18
Wrong Part/Component (%)	7	0*	9	0*	7	0*	9
Wrong Order of Steps (%)	7	0*	9	0*	7	0*	9
Wrong Position or Orientation of Part/Component (%)	0	0*	0	0*	0	0*	0
Wrong Adjustment Technique (%)	0	0*	0	0*	0	0*	0

*Caution: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Type of Error	GENERAL TASK TYPES		
	Component Part Replacement n = 19	Preventive Maintenance n = 27	Drivetrain n = 15
Violate Good Mechanical Practice (%)	0	0	0
Wrong Technique Used (%)	0	1	13
Specification Errors (%)	42	30	20
Wrong Part/Component (%)	32	11	7
Wrong Order of Steps (%)	5	7	7
Wrong Position or Orientation of Part/Component (%)	0	0	0
Wrong Adjustment Technique (%)	0	11	0
			n = 37
			Suspension and Wheel n = 30

*Column Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

All Persons	GENERAL TASK TYPES				
	Component Part Replacement n = 26	Preventive Maintenance n = 14	Drivetrain n = 10	Brake n = 28	Suspension and Wheel n = 22
Violate Good Mechanical Practice (%)	8	0	0	4	0
Wrong Technique Used (%)	12	0	10	0	41
Specification Errors (%)	38	43	40	29	59
Wrong Part/Component (%)	19	14	0	11	18
Wrong Order of Steps (%)	4	0	10	4	18
Wrong Position or Orientation or Part/Component (%)	8	0	0	0	0
Wrong Adjustment Technique (%)	4	21	0	14	0

*Calculated Percentage in those cases based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS,
LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

All Persons	GENERAL TASK TYPES				
	Component Part Replacement n = 22	Preventive Maintenance n = 15	Drivetrain n = 7	Brake n = 12	Suspension and Wheel n = 16
Violate Good Mechanical Practice (%)	0	0	0*	8	12
Wrong Technique Used (%)	0	0	0*	0	37
Specification Errors (%)	27	20	57*	17	69
Wrong Part/Component (%)	5	7	14*	8	19
Wrong Order of Steps (%)	5	13	14*	17	12
Wrong Position or Orientation of Part/Component (%)	0	0	0*	0	6
Wrong Adjustment Technique (%)	0	7	0*	17	6

*Citation. Percent are in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Seekers	GENERAL TASK TYPES			
	Component Part Replacement n = 9	Preventive Maintenance n = 3	Drivetrain n = 1	Suspension and Tires n = 12
Violate Good Mechanical Practice (%)	0*	0*	0*	0
Wrong Technique Used (%)	0*	0*	100*	5
Specification Errors (%)	22*	67*	0*	32
Wrong Part/Component (%)	33*	0*	0*	58
Wrong Order of Steps (%)	11*	0*	0*	0
Wrong Position or Orientation of Part/Component (%)	0*	0*	9	17
Wrong Adjustment Technique (%)	0*	0*	0	8

*Cautions: Percentage in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Seekers	GENERAL TASK TYPES				
	Component Part Replacement n = 16	Preventive Maintenance n = 11	Drivetrain n = 6	Brake n = 17	Suspension and Wheel n = 12
Violate Good Mechanical Practice (%)	6	0	0*	0	0
Wrong Technique Used (%)	19	0	17*	0	42
Specification Errors (%)	56	36	50*	41	33
Wrong Part/Component (%)	19	18	0*	12	25
Wrong Order of Steps (%)	6	0	0*	6	8
Wrong Position or Orientation of Part/Component (%)	12	0	0*	0	0
Wrong Adjustment Technique (%)	6	18	0*	18	0

*Column: Percentages in this cell based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: NONE

Seekers	GENERAL TASK TYPES				
	Type of Error	Component Part Replacement n = 15	Preventive Maintenance n = 11	Drivetrain n = 4	Suspension and Wheel n = 15
Violate Good Mechanical Practice (%)	0	0	0*	11*	13
Wrong Technique Used (%)	0	0	0*	0*	33
Specification Errors (%)	40	18	50*	22*	73
Wrong Part/Component (%)	7	0	25*	11*	26
Wrong Order of Steps (%)	0	18	25*	11*	13
Wrong Position or Orientation of Part/Component (%)	0	0	0*	0*	7
Wrong Adjustment Technique (%)	0	9	0*	22*	7

*Common Percentages in this row based on less than 10 cases.

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
NO INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 7 OR MORE

Nonseekers	GENERAL TASK TYPES			
	Component Part Replacement n = 10	Preventive Maintenance n = 24	Drivetrain n = 14	Brake n = 15
Violate Good Mechanical Practice (%)	0	0	0	0
Wrong Technique Used (%)	0	1	7	13
Specification Errors	60	25	21	27
Wrong Part/Component (%)	30	12	7	0
Wrong Order of Steps (%)	0	8	7	20
Wrong Position or Orientation of Part/Component (%)	0	0	0	7
Wrong Adjustment Technique (%)	0	12	0	27

*Caution: Percentage in this cell based on less than 10 cases

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
NO INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL: 1 - 6

Nonseekers		GENERAL TASK TYPES				
Type of Error	Component Part Replacement n = 10	Preventive Maintenance n = 3	Drivetrain n = 4	Brake n = 11	Suspension and Wheel n = 10	
Violate Good Mechanical Practice (%)	10	0*	0*	9	0	
Wrong Technique Used (%)	0	0*	0*	0	40	
Specification Errors (%)	10	67*	25*	9	90	
Wrong Part/Component (%)	20	0*	0*	9	10	
Wrong Order of Steps (%)	0	0*	25*	0	30	
Wrong Position or Orientation of Part/Component (%)	0	0*	0*	0	0	
Wrong Adjustment Technique (%)	0	33*	0*	9	0	

*Caution: Percentages in this cell based on less than 10 observations

BASELINE DATA, MDS 63B/C, 1978-80

**OBSERVATIONS WITH ONE OR MORE SERIOUS UNCORRECTED ERRORS AND
NO INFORMATION SEEKING, LISTED BY MAJOR ERROR TYPE**
(Percent of Total Observations of Each Task Type)

PRIOR TASK EXPERIENCE LEVEL:NONE

Nonseekers		GENERAL TASK TYPES				
Type of Error	Component Part Replacement n = 7	Preventive Maintenance n = 4	Drivetrain n = 3	Brake n = 3	Suspension and Wheel n = 1	
Violate Good Mechanical Practice (%)	0*	0*	0*	0*	0*	0*
Wrong Technique Used (%)	0*	0*	0*	0*	0*	100*
Specification Errors (%)	0*	25*	67*	0*	0*	0*
Wrong Part/Component (%)	0*	25*	0*	0*	0*	0*
Wrong Order of Steps (%)	14*	0*	0*	0*	0*	0*
Wrong Position or Orientation of Part/Component (%)	0*	0*	0*	0*	0*	0*
Wrong Adjustment Technique (%)	0*	0*	0*	0*	0*	0*

*Caution Percentage in this cell based on less than 10 cases

GLOSSARY OF TERMS

MECHANICS' TASK EXPERIENCE

Prior Task Experience - the number of times the mechanic reported having previously performed the same or similar work assignment. The three levels (7 or more times, 1 to 6, none) were formed using Multiple Discriminant Function techniques.

TASK CHARACTERISTICS

General - ratings made during the front-end analysis performed for each task prior to conduct of the observations. These ratings, with the exception of Operational Checkout Required, are defined in Figure 1.

Operational Checkout Required - A yes/no rating made after the observation was completed. Determination of when a checkout was required before considering an assignment successfully completed depended on such things as the scope of the mechanic's work assignment (for example, only to remove a component), availability of replacement parts, and the operational status of the vehicle apart from the mechanic's assignment.

Levels of Task Characteristics - each of the four task characteristics rated on the five-point scale (Figure 1) were divided into two categories by making a median split for the judged difficulty of each based on the ratings for all tasks observed. These two categories are labeled "easy/hard" or "clear/unclear" depending on the particular characteristic. The two levels for the task characteristics rated "yes/no" are simply based on those ratings.

GENERAL TASK TYPES

General - the five listed task types were selected from a number of possible task typologies on the basis of correlational analyses. These task types seemed to clearly group tasks in ways that assisted prediction of information-seeking or error behaviors, yet make meaningful groups in terms of automotive principles.

Component Part Replacement - Examples: remove/install carburetor; remove/install exhaust pipe.

Preventive Maintenance - Examples: tune-up engine; remove/install oil filters.

Drivetrain - Examples: remove/install U-joints; adjust clutch linkage.

Brake - Examples: remove/install wheel cylinders; bleed brakes.

Suspension and Wheel - Examples: remove/install inner axle seal; adjust toe-in; adjust wheel bearings.

INFORMATION DEMAND RATING

Perceptual Dimension

1.	<input type="checkbox"/>	2	<input type="checkbox"/>	3	<input type="checkbox"/>	4	<input type="checkbox"/>	5
Visual Accessibility		easy						hard

(Can the part or component to be worked on be seen easily - such as the upper radiator hose? Or is it hard to see - such as the parking brake drum?)

2.	<input type="checkbox"/>	2	<input type="checkbox"/>	3	<input type="checkbox"/>	4	<input type="checkbox"/>	5
Manual Accessibility		easy						hard

(Can the part or component to be worked on be gotten to easily - such as the radiator cap? Or is it hard to get to - such as the double spray linkage?)

Cognitive Dimension

1.	<input type="checkbox"/>	2	<input type="checkbox"/>	3	<input type="checkbox"/>	4	<input type="checkbox"/>	5
Clarity of Necessary Task Steps		clear						unclear

(Is it clear that something has to be done first - such as removing the spark plug wire before removing spark plug? Or is it unclear whether something has to be done before starting on the central task - such as disconnecting the battery ground before removing an electric fuel pump?)

2.	<input type="checkbox"/>	2	<input type="checkbox"/>	3	<input type="checkbox"/>	4	<input type="checkbox"/>	5
Clarity of Techniques to Perform Task Steps		clear						unclear

(Is it clear as to just what needs to be done first - such as removing the distributor cap and rotor before cleaning the breaker points? Or is it unclear, such as which tubes and hoses must be removed before removing the cylinder head?)

Performance Requirements

1.	<input type="checkbox"/>	0	<input type="checkbox"/>	1
Special Tools Required		no		yes

(Are any tools required that are not found in the mechanic's common tool box - such as torque wrenches, timing light, feeler guages?)

2.	<input type="checkbox"/>	0	<input type="checkbox"/>	1
Formal Specification Required		no		yes

(Does the task require any close tolerances or fine adjustments - such as torque cylinder head bolts, or adjusting valve tappet clearance?)

Figure Illustration of the Information Demand Rating

INFORMATION-SEEKING EVENTS

General - observed actions of the mechanic directed toward acquiring information to assist in completing the assigned mechanical maintenance task.

Information Sources -

Person-Ask - refers to task relevant information obtained by directly asking a specific question of a supervisor or co-worker.

Person-Discuss - refers to discussions in which the mechanic and one or more persons talk over the task but it is not clear who is requesting or giving information (i.e., information flow directions are confused).

Printed Material - refers to any consulting with technical manuals where there is written, photographic or graphic material presented.

Types of Information Sought -

Location/Identification of Components - Questions about the nomenclature of task-related hardware items and where they are located on the equipment being worked on.

Technique for a Task Step - Questions concerning how to complete the task step presently being performed. Examples include information about how to remove a brake shoe clip, how to detach a universal joint, or special precautions to be followed.

Task Steps Required for Completion - Questions about what the next step in the task is. This type of ISB is distinguished from Technique for a Task Step by whether the question addresses "what to do next?" That is, if the mechanic seeks information about how to successfully complete the action presently engaged in, it is a Technique event. If the mechanic completes a step, then seeks information about what to do next, it is a Task Steps Required for Completion event.

Formal Specification Data - Questions about the range of conditions and indications for a device operating within acceptable limits. Examples of specification information include torque values, electrical values, and pictures of acceptable and unacceptable spark plug conditions.

Help on Serviceability Judgement - Questions about whether or not an equipment part or assembly is serviceable in its present condition. Examples include such questions as, "Are these bearings OK?", or "Can I use this gasket again?"

Help on Alignment Judgement - Questions about whether or not an adjustment has been completed correctly or whether equipment parts or assemblies are correctly positioned (aligned). Examples include such questions as, "Is this the right brake pressure?", or "Is this road wheel on all the way?"

ERROR EVENTS

Process Error Events - actions of the mechanic during task performance, whether or not later corrected, which were not in conformance with US Army doctrine (as defined by Technical Manuals), or which, in the judgment of the observer, did not conform to generally accepted good mechanical practices, or which had negative results in terms of task completion.

Serious Uncorrected Errors - any error which was left uncorrected when the mechanic stated that the job was finished and which, in the opinion of expert mechanics, would result in (a) shortening the serviceable vehicle life, (b) immediately endanger the vehicle, (c) endanger drivers or passengers in the vehicle, and (d) endanger by-standers near the vehicle.

Specific Types of Errors -

Violate Good Mechanical Practices - Errors made when the mechanic violates good general mechanical practice. These are errors which often lead to damaged parts or sloppy workmanship. Examples include improperly greasing wheel bearings, and failing to drain oil reservoir before attempting to change primary oil filter.

Wrong Technique Used - Errors when the mechanic uses the wrong tools or procedure during the task process. Errors of this type often lead to damaged equipment parts. Examples include not using a sling to support heavy equipment parts being removed or installed, and prying with a screwdriver to remove an oil filter element, and damaging the element.

Specification Errors - Process errors made when the mechanic does not follow exact specification requirements stated in the Task Manual. Examples include adjusting contact breaker points to an incorrect gap width, or tightening cylinder head bolts to an incorrect or unknown torque.

Wrong Part/Component - Errors made when an incorrect equipment part is installed, or an attempt is made to install it. Occasions when an equipment part is left out of an assembly are also Parts Errors. Examples include installing a secondary oil filter in the primary filter case, or leaving out part of the U-joint assembly.

Wrong Order of Steps - Errors made when the mechanic does task steps out of their prescribed order. (Occasions when task steps are completely omitted are also Order-of-Steps Error.) Examples include repeated efforts to pull off a brake drum before contracting brake shoes, or repeated attempts to pull out generator before removing all attached wires.

Wrong Position or Orientation of Part/Component - This error usually occurs when equipment parts are installed in such a place or rotated so that they cannot be properly seated and attached. An example is seating an oil cooler in such a position that the inflow/outflow links cannot be attached.

Wrong Adjustment Technique - Errors made when the mechanic uses a wrong tool or procedure to complete adjustment of an equipment part. Examples include turning an adjustment the wrong way to tighten/loosen it, and not jacking up a jeep before adjusting the wheel bearings.